

Reply to Office Action of October 04, 2004  
Amendment Dated: November 22, 2004

Appl. No.: 09/824,837  
Attorney Docket No.: CSCO-004/3579

Amendments to Specification

Please replace the paragraph beginning at page 5 line 15, with the following rewritten paragraph:

5 In an alternative embodiment, a tunnel is provisioned using UDP/IP protocol based transport backbone. In the case the layer-3 corresponding corresponds to IP (Internet Protocol), the TOS (type of service)/precedence bits of the IP datagram may be copied into the same field of the UDP/IP packet supporting the tunnel. Accordingly, the IP datagrams may receive the QOS specified by the TOS/precedence bits indicated by the datagram header.

10 Please replace the paragraph beginning at page 7 line 19, with the following rewritten paragraph:

15 Remote systems 110-A through 110-X are used by subscribers (or end users) to access hosts of interest. Devices commonly known as customer premise equipment (CPE) and computer systems with modems are examples of remote systems 110-A through 110-X. Each remote system 110-A through 110-X may access a desired host 190-A or 190-B. Remote systems 110-A through 110-X send and receive datagrams consistent with layer-3 protocols according to pre-determined conventions. The data in the datagrams serves as a basis for supporting several user applications between hosts 190-A and 190-B, and remote systems 110-A through 110-X.

20 Please replace the paragraph beginning at page 9 line 12, with the following rewritten paragraph:

25 In step 270, the data in the datagram is encapsulated to in packets, with the packet header being set to provide the determined QOS. The packets contain the tunnel information in addition. The packet header is determined by the specific protocol implemented on backbone path 157-A. In an example embodiment described below, the tunnels are described as being implemented within UDP/IP protocol stack.

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Please replace the paragraph beginning at page 10 line 4, with the following rewritten paragraph:

5 Figure 3 is a block diagram illustrating the internals of NAS 150 in an embodiment of the present invention. The embodiment is described in the context of datagrams received on point-to-point sessions (set up between remote system 110-A and home gateway ~~170~~ 170-A) and L2TP tunnels implemented using VC bundles (set up between NAS 150 and home gateway ~~170~~ 170-A) containing multiple ATM virtual circuits on backbone 157-A.

10 Please replace the paragraph beginning at page 11 line 8, with the following rewritten paragraph:

15 Each component of network aggregation access server 150 may be implemented in a combination of one or more of hardware, software and firmware. In general, when throughput performance is of primary consideration, the implementation is performed more in hardware (e.g., in the form of an application specific integrated circuit). When cost is of primary consideration, the implementation is performed more in software (e.g., using a processor executing instructions provided in software/firmware). Cost and performance can be balanced by implementing network aggregation access server 150 with a desired mix of hardware, software and/or firmware.

20 Please replace the paragraph beginning at page 12 line 12, with the following rewritten paragraph:

Tunnel encapsulator 350 encapsulates the data in the datagram according to a tunneling protocol. The tunnel is set up between NAS 150 and home gateway ~~170~~ 170-A in a known way. In an embodiment, tunnel encapsulator 350 is implemented consistent with RFC 2661 noted above.

25 Please replace the paragraph beginning at page 13 line 1, with the following rewritten paragraph:

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In addition, table 366 may contain protocol encapsulation information to provide each type of QOS provided by NAS 150. In one embodiment, a tunnel between NAS 150 and home gateway 170-A is implemented using multiple ATM virtual circuits forming a VC bundle, with each virtual circuit providing a different (set of) QOS. Thus, table 366 may be configured to indicate the specific virtual circuit (e.g., by a virtual circuit identifier) to be used for each QOS. Table 366 may be implemented using a memory. A non-volatile memory (potentially provided external to NAS 150) may be used to store the data permanently, and the data may be loaded into a random access memory (RAM) during the operation of NAS 150 for a superior performance.

10 Please replace the paragraph beginning at page 14 line 10, with the following rewritten paragraph:

Accordingly, each packet (or datagram) in the UDP/IP tunnel may have the same TOS/precedence bits of the transported packet. As the UDP/IP packet in the tunnel may be provided the QOS corresponding to the TOS/precedence bits, the transported datagram 15 may receive desired QOS. Also, as noted above, the components of NAS 150 may be implemented in the form of software also. An example software implementation is described below in further detail.

Please replace the paragraph beginning at page 15 line 8, with the following rewritten paragraph:

20 Network interface 480 enables NAS 150 to send and receive data on communication networks using protocols as asynchronous transfer mode (ATM). Network interface 480 may correspond to input interface 310 and output interface 390 370 of Figure 3. Network interface 480, output interface 460 and input interface 490 can be implemented in a known way.

25 Please replace the paragraph beginning at page 15 line 12, with the following rewritten paragraph:

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RAM 420 and storage 430 may together be referred to as a memory. RAM 430  
420 may receive instructions and data on path 450 from storage 430. Secondary memory  
Storage 430 may contain units such as hard drive 435 and removable storage drive 437.  
Secondary storage Storage 430 may store the software instructions and data, which enable  
5 NAS 450 150 to provide several features in accordance with the present invention.

Please replace the paragraph beginning at page 16 line 11, with the following  
rewritten paragraph:

10 Thus, NAS 150 may be implemented substantially in software to provide different  
QOS to different datagrams. Home gateway 170 170-A and other network devices may  
also be implemented similarly to provide differentiated services as will be apparent to one  
skilled in the relevant arts by reading the disclosure provided herein. Such other  
implementations are also contemplated to be within the scope and spirit of the present  
invention.